PATENT ABSTRACTS OF JAPAN

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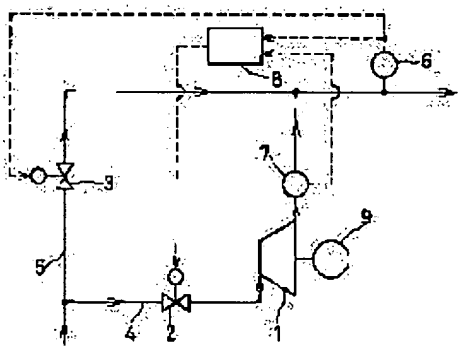
(54) CONTROL DEVICE FOR CITY GAS LINE ENERGY RECOVERY TURBINE

(57)Abstract:



PROBLEM TO BE SOLVED: To hold a pressure in a spot situated downstream from a turbine at a constant value in all cases of the starting period, the operation period, and the stop period of the turbine, to maintain a generation amount at a maximum, and to prevent the occurrence of overload operation of the turbine, in a system to effect recovery of city gas line energy by an expansion turbine.

SOLUTION: An automatic pressure regulating valve for turbine 2 is located in a gas line 4 on the inlet side of an expansion turbine 1 and a bypass line 5 having an automatic pressure regulation valve for bypass 3 is arranged in a state to intercouple the inlet side of the automatic pressure regulation valve for turbine 2 and the exhaust side of an expansion turbine 1. Pressure.flow regulating means 6, 7, and 8 are provided such that through control of opening and closing of the automatic pressure regulation valve for bypass 3 during the starting and the stop of operation of the expansion turbine 1, a pressure regulation means 6 to hold a pressure in a spot situated downstream from a confluent line of a turbine line and a bypass line at a constant value and the automatic pressure regulating valve for turbine 2 are opened and closed so that, during operation of the expansion turbine 1, a flow rate through a turbine line is adjusted to a value approximately equal to a given value in a range not to exceed the given value, and a pressure in a downstream spot is held at a constant value.

CLAIMS

[Claim(s)]

[Claim 1]A control device of a town gas line energy recovery turbine characterized by comprising the following.

While interposing an automatic pressure regulating valve for turbines in a pipeline connected to an entrance side of an expansion turbine for energy recoveries which is installed in a town gas line, and with which cold energy use and power generation are presented, While connecting an entrance side of said automatic pressure regulating valve for turbines, and an exhaust side of an expansion turbine and providing a by-pass line provided with an automatic pressure regulating valve for a bypass, opening and closing control of said automatic pressure regulating valve for a bypass is carried out at the time of starting and shutdown of an expansion turbine, A regulation-of-pressure means by which downstream pressure of a confluent line of a turbine line and a bypass line is held uniformly.

The amount regulation means of pressure flow by which carries out opening and closing control of said automatic pressure regulating valve for turbines so that a flow of a turbine line may approach this predetermined value in the range which does not exceed a predetermined value at the time of operation of an expansion turbine, and said downstream pressure is held uniformly.

[Claim 2]A control device of a town gas line energy recovery turbine characterized by comprising the following.

While forming a nozzle of an expansion turbine for energy recoveries which is installed in a town gas line and with which cold energy use and power generation are presented in a variable nozzle in which flow regulation is possible, While connecting an entrance side and an exhaust side of an expansion turbine and providing a by-pass line provided with an automatic pressure regulating valve for a bypass, opening and closing control of said automatic pressure regulating valve for a bypass is carried out at the time of starting and shutdown of an expansion turbine, A regulation-of-pressure means by which downstream pressure of a confluent line of a turbine line and a bypass line is held uniformly.

A nozzle regulation means by which carries out increase and decrease of said variable nozzle of control so that a flow of a turbine line may approach this predetermined value in the range which does not exceed a predetermined value at the time of operation of an expansion turbine, and said downstream pressure is held uniformly.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]In this invention, it is provided all over a town gas supply line, and high-pressure distributed gas is directly expanded as a working medium.

Therefore, it is related with the control device for aiming at gas adequate supply of the energy recovery turbine with which cold energy use and power generation are presented.

[0002]

[Description of the Prior Art]It is installed in the centrifugal-spark-advancer station relevant to a town gas supply line, etc., The typical advanced technology of the cold energy use power generating plant relevant to the turbine which expands directly low-temperature high voltage NG which is a raw material of town gas is indicated by JP,57-114139,U (the 1st conventional example) and JP,58-136603,U (the 2nd conventional example). The 1st conventional example has composition which made bypass connection of the by-pass line which the automatic pressure regulating valve passed for stabilization of NG supply at the time of turbine stoppage between the entrance side of a turbine, and the exhaust side, and the automatic pressure regulating valve of a by-pass line is controlled by the pressure controller provided in the turbine lower stream.

[0003]On the other hand, the 2nd conventional example is the composition of having installed the automatic pressure regulating valve in the turbine inlet, and having made only both the pressures of the turbine lower stream controlling as a detecting signal in addition to the automatic pressure regulating valve of a by-pass line.

[0004]

[Problem(s) to be Solved by the Invention]Since it is a control means in which this operates only at the time of a stop of a turbine in the case of the 1st conventional example, when changing gas supply volume sharply at the time of starting of a turbine and operation, it does not have a means which holds the pressure of the turbine lower stream uniformly and supplies gas adequately.

[0005]Since it has only the function to control uniformly the downstream pressure as the flow sum of a turbine line and a bypass line, the control of flow according to turbine line individual is impossible for the case of the 2nd conventional example. Therefore, it has neither the control which maintains the production of electricity of a turbine to the maximum, nor a control means which opens a bypass valve and is held to a predetermined turbine flow rate when a turbine line has too many flows and it becomes an overload (overspeed r.p.m. by a fault flow).

[0006]Accomplish this invention in order to aim at dissolution of such a problem, and the purpose of this invention, In the system which makes the town gas line energy recovery by this kind of expansion turbine measure, While holding the pressure of the turbine lower stream uniformly to all the cases at the time of operation including the time of starting of a turbine, and a flow rate change, and a stop and aiming at adequate supply of gas, it is in maintaining the production of electricity in a turbine to the maximum, and avoiding overload operation of a turbine, and improving operating efficiency and safety.

[0007]

[Means for Solving the Problem]This invention is considered as composition described below in order to attain the above-mentioned purpose. Namely, while interposing an automatic pressure regulating valve for turbines in a pipeline connected to an entrance side of an expansion turbine for energy recoveries which

installs this invention in a town gas line, and with which cold energy use and power generation are presented, While connecting an entrance side of said automatic pressure regulating valve for turbines, and an exhaust side of an expansion turbine and providing a by-pass line provided with an automatic pressure regulating valve for a bypass, opening and closing control of said automatic pressure regulating valve for a bypass is carried out at the time of starting and shutdown of an expansion turbine, A regulation-of-pressure means by which downstream pressure of a confluent line of a turbine line and a bypass line is held uniformly, Opening and closing control of said automatic pressure regulating valve for turbines is carried out so that a flow of a turbine line may approach this predetermined value in the range which does not exceed a predetermined value at the time of operation of an expansion turbine, Said downstream pressure is a control device of a town gas line energy recovery turbine which establishes the amount regulation means of pressure flow held uniformly, and is characterized by things.

[0008]While this invention forms a nozzle of an expansion turbine for energy recoveries which is installed in a town gas line and with which cold energy use and power generation are presented again in a variable nozzle in which flow regulation is possible, While connecting an entrance side and an exhaust side of an expansion turbine and providing a by-pass line provided with an automatic pressure regulating valve for a bypass, opening and closing control of said automatic pressure regulating valve for a bypass is carried out at the time of starting and shutdown of an expansion turbine, A regulation-of-pressure means by which downstream pressure of a confluent line of a turbine line and a bypass line is held uniformly, Increase and decrease of said variable nozzle of control are carried out so that a flow of a turbine line may approach this predetermined value in the range which does not exceed a predetermined value at the time of operation of an expansion turbine, Said downstream pressure is a control device of a town gas line energy recovery turbine which establishes a nozzle regulation means held uniformly and is characterized by things.

[0009]

[Embodiment of the Invention]It explains referring to the accompanying drawing in which an example is shown about the desirable embodiment of this invention below. The outline system of the gas supply power generating plant to which one example of the invention according to claim 1 is applied is shown in drawing 1. This gas supply power generating plant is provided, for example all over a town gas supply line, and The expansion turbine 1, The gas pipe passage 4 which is connected to the entrance side of this expansion turbine 1, and forms the important section of a turbine line, The downstream gas pipe passage which is connected to the exhaust side of the expansion turbine 1, and similarly forms the important section of a turbine line, and the expansion turbine 1 are equipped with the dynamo 9 by which axial connection was carried out, and the high speed circuit of a town gas supply line is constituted by these.

[0010]The control device which controls operation of a turbine is formed to this high speed circuit. This device comprises the automatic pressure regulating valve 2 for turbines, the by-pass line (bypass line) 5 where the automatic pressure regulating valve 3 for a bypass was interposed, the pressure gauge 6, the flow instrument 7, and the amount automatic controller 8 of pressure flow. The automatic pressure regulating valve 2 for turbines is interposed in the middle of the gas pipe passage 4, and the pressure and flow of the gas fed into the expansion turbine 1 are adjusted. The bypass line 5 connects the entrance side of the automatic pressure regulating valve 2 for turbines, and the exhaust side of the expansion turbine 1, and is provided. The automatic pressure regulating valve 3 for a bypass adjusts the pressure and flow of the gas

which circulates the bypass line 5.

[0011]It transmits a detecting signal to the amount automatic controller 8 of pressure flow while the pressure gauge 6 is formed in the confluent line linked to the exhaust side pipeline and said by-pass line 5 of the expansion turbine 1, detects the downstream pressure of a confluent line and carries out opening and closing control of the automatic pressure regulating valve 3 for a bypass. The flow instrument 7 detects the gas mass flow of the exhaust side pipeline of the expansion turbine 1, and transmits a detecting signal to the amount automatic controller 8 of pressure flow. The amount automatic controller 8 of pressure flow carries out opening and closing control of the automatic pressure regulating valve 2 for turbines in response to the detecting signal of the pressure gauge 6 and the flow instrument 7.

[0012]The above-mentioned gas supply power generating plant makes LNG pressure up, uses as a working medium the high pressure gas (NG) generated by evaporating, and it is made to expand directly with the expansion turbine 1, While storing in a reservoir tank etc. NG to which the pressure which came out of the expansion turbine 1 fell through said confluent line, the velocity energy generated with the expansion turbine 1 is transformed into electrical energy with the dynamo 9.

[0013]Next, operation by said control device is explained. The pressure gauge 6 detects a rise and fall of exhaust gas pressure at the time of starting of the expansion turbine 1 and a stop, and the control signal for holding uniformly the downstream pressure of the confluent line of a turbine line and a bypass line is outputted to the automatic pressure regulating valve 3 for a bypass. A switching action is carried out, a valve opening is adjusted by this, the bypass flow rate of the bypass line 5 is controlled by it, a rise and fall of a pressure are prevented, and the automatic pressure regulating valve 3 for a bypass can hold downstream pressure uniformly by it.

[0014]On the other hand, when the pressure of a turbine line is during operation of the expansion turbine 1 and a flow has change, A control signal for the pressure gauge 6 and the flow instrument 7 to detect change of a pressure and a flow, and hold uniformly the pressure of a confluent line and the flow of a turbine line through the amount automatic controller 8 of pressure flow is outputted to the automatic pressure regulating valve 2 for turbines. In this case, a turbine flow rate is held to the predetermined maximum so that the flow of a turbine line may be controlled first and a production of electricity may be made into the maximum to two control elements, a pressure and a flow, in the flow rate range which does not exceed the predetermined value defined beforehand, and downstream pressure is uniformly held by opening and closing of the automatic pressure regulating valve 3 for a bypass. Namely, opening and closing control of the automatic pressure regulating valve 2 for turbines is carried out so that the flow of a turbine line may approach this predetermined value in the range which does not exceed a predetermined value, It is able to make it to make said downstream pressure hold uniformly with the automatic pressure regulating valve 3 for a bypass furthermore, and, moreover, the overload of the turbine 1 can be prevented.

[0015]The outline system of the gas supply power generating plant to which the other examples of the invention according to claim 2 are applied is shown in drawing 2. In the control device of this gas supply power generating plant, the same reference mark is given to each member which is similar and corresponds to the control device of the example shown in drawing 1, the explanation which overlaps here is avoided, and a characteristic portion is described below.

[0016]The point which attracts attention especially in the above-mentioned example shown in drawing 2,

The nozzle provided in the surroundings of a bucket is formed in the variable nozzle 10 in which flow change is possible in the expansion turbine 1, for example, a radial turbine, As a mechanism in which the flow of this variable nozzle 10 is adjusted, with actuators, such as an air cylinder and a servo motor, the nozzle operation unit 11 of the common knowledge which can be operated from the outside of a turbine casing, They are two points of having a nozzle regulation means which comprises the nozzle regulator 12 which automates this nozzle operation unit 11. And the nozzle regulator 12 controls travel, such as a stroke of the nozzle operation unit 11, and number of rotations, in response to the detecting signal of the pressure gauge 6 and the flow instrument 7.

[0017]Subsequently, operation by a control device is explained. The pressure gauge 6 detects a rise and fall of exhaust gas pressure at the time of starting of the expansion turbine 1 and a stop, and the control signal for holding uniformly the downstream pressure of the confluent line of a turbine line and a bypass line is outputted to the automatic pressure regulating valve 3 for a bypass. A switching action is carried out, a valve opening is adjusted by this, the bypass flow rate of the bypass line 5 is controlled by it, the failure of pressure is prevented, and the automatic pressure regulating valve 3 for a bypass can hold downstream pressure uniformly by it.

[0018]On the other hand, when the pressure of a turbine line is during operation of the expansion turbine 1 and a flow has change, a control signal for the pressure gauge 6 and the flow instrument 7 to detect change of a pressure and a flow, and hold uniformly the pressure of a confluent line and the flow of a turbine line through the nozzle regulator 12 is outputted to the nozzle operation unit 11. In this case, a turbine flow rate is held to the predetermined maximum so that the flow of a turbine line may be controlled first and a production of electricity may be made into the maximum to two control elements, a pressure and a flow, in the flow rate range which does not exceed the predetermined value defined beforehand, and downstream pressure is uniformly held by opening and closing of the automatic pressure regulating valve 3 for a bypass. That is, it is able to make it to make said downstream pressure hold uniformly by carrying out opening and closing control of the variable nozzle 10 so that the flow of a turbine line may approach this predetermined value in the range which does not exceed a predetermined value, and moreover, the overload of the turbine 1 can be prevented.

[0019]

[Effect of the Invention]This invention is carried out with a gestalt which was explained above, and does so an effect which is indicated below.

[0020]Among this inventions, in the time of operation, the invention according to claim 1 can attain the reservation of the maximum production of electricity or the amount of cold energy according to a situation while keeping the downstream pressure of a turbine constant under all the situations of starting, operation, and a stop. In order to operate in the range which does not exceed a specified flow rate, operation which a turbine did not carry out an overload (fault flow) and was stabilized is guaranteed.

[0021]Among this inventions, since a big turbine head is obtained rather than being able to set the invention according to claim 2 as compared with the effect of the invention according to claim 1 at the time of operation, the effect that a production of electricity and the larger amount of cold energy can be taken is done so.

[Brief Description of the Drawings]

[Drawing 1]It is an outline distribution diagram of the gas supply power generating plant by one example of this invention.

[Drawing 2]It is an outline distribution diagram of the gas supply power generating plant by the other examples of this invention.

[Description of Notations]

1 [— A gas pipe passage, 5 / — A by-pass line and 6 / — A pressure gauge, 7 / — A flow instrument and 8 / — The amount automatic controller of pressure flow 9 / — A dynamo, 10 / — A variable nozzle, 11 / — A nozzle operation unit and 12 / — Nozzle regulator,] — An expansion turbine and 2 — The automatic pressure regulating valve for turbines, 3 — The automatic pressure regulating valve for a bypass, and 4

[Translation done.]

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審査請求　未請求　請求項の数２　ＯＬ　（全　４　頁）

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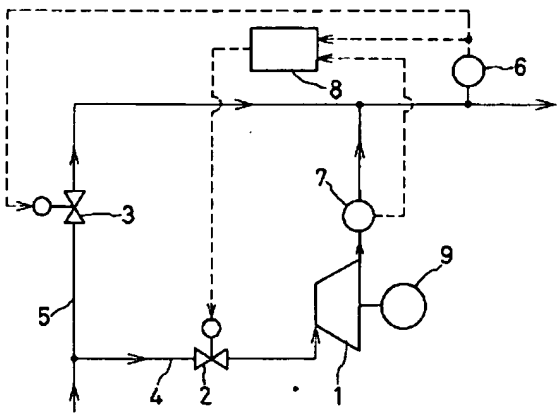
(54)【発明の名称】　都市ガスラインエネルギー回収タービンの制御装置

(57)【要約】

【課題】　膨張タービンによる都市ガスラインエネルギー回収をはからせるシステムにおいて、タービンの起動時、運転時、停止時の全てのケースに対してタービン下流圧力を一定に保持し、発電量を最大に維持し、タービンのオーバーロード運転を回避する。

【解決手段】　膨張タービンの１入口側のガス管路４にタービン用自動調圧弁２を介設し、バイパス用自動調圧弁３を持つバイパス管路５をタービン用自動調圧弁２の入口側と膨張タービン１の排気側とを結んで設ける。バイパス用自動調圧弁３を膨張タービン１の起動・運転停止時に開閉制御して、タービンラインとバイパスラインの合流ラインの下流圧が一定に保持されるようにする圧力調節手段６と、タービン用自動調圧弁２を膨張タービン１の運転時にタービンラインの流量が所定値を超えない範囲で該所定値に近づくように開閉制御して、下流圧が一定に保持されるようにする圧力流量調節手段６、７、８とを設ける。



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【特許請求の範囲】
【請求項１】　都市ガスラインに設置して冷熱利用や発電に供するエネルギー回収用の膨張タービンの入口側に接続される管路にタービン用自動調圧弁を介設するとともに、バイパス用自動調圧弁を備えるバイパス管路を前記タービン用自動調圧弁の入口側と膨張タービンの排気側とを結んで設ける一方、前記バイパス用自動調圧弁を膨張タービンの起動・運転停止時に開閉制御して、タービンラインとバイパスラインの合流ラインの下流圧が一定に保持されるようにする圧力調節手段と、前記タービン用自動調圧弁を膨張タービンの運転時にタービンラインの流量が所定値を超えない範囲で該所定値に近づくように開閉制御して、前記下流圧が一定に保持されるようにする圧力流量調節手段とを設けてなることを特徴とする都市ガスラインエネルギー回収タービンの制御装置。
【請求項２】　都市ガスラインに設置して冷熱利用や発電に供するエネルギー回収用の膨張タービンのノズルを流量調節可能な可変ノズルに形成するとともに、バイパス用自動調圧弁を備えるバイパス管路を膨張タービンの入口側と排気側とを結んで設ける一方、前記バイパス用自動調圧弁を膨張タービンの起動・運転停止時に開閉制御して、タービンラインとバイパスラインの合流ラインの下流圧が一定に保持されるようにする圧力調節手段と、前記可変ノズルを膨張タービンの運転時にタービンラインの流量が所定値を超えない範囲で該所定値に近づくように増減制御して、前記下流圧が一定に保持されるようにするノズル調節手段とを設けて成ることを特徴とする都市ガスラインエネルギー回収タービンの制御装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、都市ガス供給ライン中に設けられて高圧の供給ガスを作動媒体として直接膨張させることにより冷熱利用と発電に供するエネルギー回収タービンのガス安定供給を図るための制御装置に関する。
【０００２】
【従来の技術】都市ガス供給ラインに関連するガバナーステーション等に設置されて、都市ガスの原料である低温高圧ＮＧを直接膨張させるタービンに関連する冷熱利用発電プラントの典型的な先行技術が、実開昭57－114139号公報（第１従来例）及び実開昭58－136603号公報（第２従来例）に開示されている。第１従来例は、タービン停止時のＮＧ供給の安定化のために、自動調圧弁が介されたバイパス管路をタービンの入口側と排気側との間にバイパス接続した構成となっていて、バイパス管路の自動調圧弁は、タービン下流に設けられた圧力調節計によりコントロールされる。
【０００３】一方、第２従来例は、バイパス管路の自動調圧弁に加えて、タービン入口に自動調圧弁を設置して、共にタービン下流の圧力だけを検出信号としてコントロールさせた構成である。

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【０００４】
【発明が解決しようとする課題】第１従来例の場合、これはタービンの停止時にのみ作動する制御手段であるため、タービンの起動時や運転時にガス供給量が大きく変動する場合、タービン下流の圧力を一定に保持しガスの安定供給を行う手段を有しない。
【０００５】また、第２従来例の場合は、タービンラインとバイパスラインの流量和としての下流圧を一定にコントロールする機能しか有しないので、タービンライン個別の流量制御が不可能である。従って、タービンの発電量を最大に維持する制御や、タービンラインに流量が多すぎてオーバーロード（過流量による過回転）となるような場合にバイパス弁を開くなどして所定のタービン流量に保持する制御手段を有しない。
【０００６】本発明は、このような問題点の解消を図るために成されたものであり、本発明の目的は、この種の膨張タービンによる都市ガスラインエネルギー回収をはからせるシステムにおいて、タービンの起動時や流量変動を含む運転時と停止時の全てのケースに対してタービン下流の圧力を一定に保持し、ガスの安定供給を図るとともに、タービンでの発電量を最大に維持し、かつタービンのオーバーロード運転を回避して、運転効率及び安全性を高めることにある。
【０００７】
【課題を解決するための手段】本発明は、上記の目的を達成するため以下に述べる構成としたものである。即ち、本発明は、都市ガスラインに設置して冷熱利用や発電に供するエネルギー回収用の膨張タービンの入口側に接続される管路にタービン用自動調圧弁を介設するとともに、バイパス用自動調圧弁を備えるバイパス管路を前記タービン用自動調圧弁の入口側と膨張タービンの排気側とを結んで設ける一方、前記バイパス用自動調圧弁を膨張タービンの起動・運転停止時に開閉制御して、タービンラインとバイパスラインの合流ラインの下流圧が一定に保持されるようにする圧力調節手段と、前記タービン用自動調圧弁を膨張タービンの運転時にタービンラインの流量が所定値を超えない範囲で該所定値に近づくように開閉制御して、前記下流圧が一定に保持されるようにする圧力流量調節手段とを設けてなることを特徴とする都市ガスラインエネルギー回収タービンの制御装置である。
【０００８】本発明はまた、都市ガスラインに設置して冷熱利用や発電に供するエネルギー回収用の膨張タービンのノズルを流量調節可能な可変ノズルに形成するとともに、バイパス用自動調圧弁を備えるバイパス管路を膨張タービンの入口側と排気側とを結んで設ける一方、前記バイパス用自動調圧弁を膨張タービンの起動・運転停止時に開閉制御して、タービンラインとバイパスライン

の合流ラインの下流圧が一定に保持されるようにする圧力調節手段と、前記可変ノズルを膨張タービンの運転時にタービンラインの流量が所定値を超えない範囲で該所定値に近づくように増減制御して、前記下流圧が一定に保持されるようにするノズル調節手段とを設けて成ることを特徴とする都市ガスラインエネルギー回収タービンの制御装置である。

【０００９】

【発明の実施の形態】以下に本発明の好ましい実施の形態について実施例が示される添付図面を参照しながら説明する。図１には、請求項１記載の発明の一実施例が適用されるガス供給発電プラントの概略系統が示される。このガス供給発電プラントは、例えば都市ガス供給ライン中に設けられるものであって、膨張タービン１と、この膨張タービン１の入口側に接続されてタービンラインの要部を形成するガス管路４と、膨張タービン１の排気側に接続されて同じくタービンラインの要部を形成する下流側ガス管路と、膨張タービン１に軸連結された発電機９とを備えて、これらにより都市ガス供給ラインの主系統が構成される。

【００１０】この主系統に対して、タービンの運転を制御する制御装置が設けられる。この装置は、タービン用自動調圧弁２と、バイパス用自動調圧弁３が介設されたバイパス管路（バイパスライン）５と、圧力計６と、流量計７と、圧力流量調節計８とから成っている。タービン用自動調圧弁２は、ガス管路４の途中に介設されて、膨張タービン１に送給するガスの圧力・流量を調節する。バイパスライン５は、タービン用自動調圧弁２の入口側と膨張タービン１の排気側とを結んで設けられる。バイパス用自動調圧弁３は、バイパスライン５を流通するガスの圧力・流量を調節する。

【００１１】圧力計６は、膨張タービン１の排気側管路と前記バイパス管路５とに接続した合流ラインに設けられて、合流ラインの下流圧を検出し、バイパス用自動調圧弁３を開閉制御するとともに、圧力流量調節計８に検出信号を伝達する。流量計７は、膨張タービン１の排気側管路のガス流量を検出して圧力流量調節計８に検出信号を伝達する。圧力流量調節計８は、圧力計６及び流量計７の検出信号を受けてタービン用自動調圧弁２を開閉制御する。

【００１２】上記ガス供給発電プラントは、ＬＮＧを昇圧、気化して生成される高圧ガス（ＮＧ）を作動媒体として膨張タービン１で直接膨張させ、膨張タービン１から出た圧力が低下したＮＧを前記合流ラインを経て例えばリザーバータンク等に貯留する一方、膨張タービン１で発生する速度エネルギーを発電機９によって電気エネルギーに変換するようになっている。

【００１３】次に、前記制御装置による動作を説明する。膨張タービン１の起動時や停止時に圧力計６が排気圧力の上昇ならびに低下を検出して、タービンラインとバイパスラインの合流ラインの下流圧を一定に保持するための制御信号をバイパス用自動調圧弁３に出力する。これによって、バイパス用自動調圧弁３は開閉動作して弁開度が調節され、バイパスライン５のバイパス流量が制御されて、圧力の上昇ならびに低下が防止され、下流圧を一定に保持することができる。

【００１４】一方、膨張タービン１の運転中にタービンラインの圧力、流量に変動があった時には、圧力計６と流量計７が圧力、流量の変化を検出して圧力流量調節計８を経て合流ラインの圧力及びタービンラインの流量を一定に保持するための制御信号をタービン用自動調圧弁２に出力する。この場合、圧力と流量の二つの制御要素に対して、まずタービンラインの流量の制御を行い、予め定められた所定値を超えない流量範囲で発電量を最大にするように、タービン流量を所定の最大値に保持すると共に、バイパス用自動調圧弁３の開閉で下流圧を一定に保持する。すなわち、タービンラインの流量が所定値を超えない範囲で該所定値に近づくようにタービン用自動調圧弁２を開閉制御し、さらにバイパス用自動調圧弁３にて前記下流圧を一定に保持させるようにすることが可能であり、しかも、タービン１のオーバーロードを防止することができる。

【００１５】図２には、請求項２記載の発明の他実施例が適用されるガス供給発電プラントの概略系統が示される。このガス供給発電プラントの制御装置において、図１に示される実施例の制御装置に類似し対応する各部材には同一の参照符号を付して、ここでは重複する説明を避けて特徴ある部分について以下に述べる。

【００１６】図２に示される上記実施例で特に注目される点は、膨張タービン１例えばラジアルタービンにおいて、動翼の周りに設けられるノズルを、流量変更可能な可変ノズル１０に形成してなることと、この可変ノズル１０の流量を調節する機構として、エアシリンダ、サーボモータ等のアクチュエータによってタービンケーシング外からの操作が可能な周知のノズル操作器１１と、このノズル操作器１１を自動操作するノズル調節器１２とから成るノズル調節手段を備えることとの２点である。そして、ノズル調節器１２は、圧力計６及び流量計７の検出信号を受けてノズル操作器１１のストローク、回転数等の作動量を制御する。

【００１７】次いで、制御装置による動作を説明する。膨張タービン１の起動時や停止時に圧力計６が排気圧力の上昇ならびに低下を検出して、タービンラインとバイパスラインの合流ラインの下流圧を一定に保持するための制御信号をバイパス用自動調圧弁３に出力する。これによって、バイパス用自動調圧弁３は開閉動作して弁開度が調節され、バイパスライン５のバイパス流量が制御されて、圧力低下が防止され、下流圧を一定に保持することができる。

【００１８】一方、膨張タービン１の運転中にタービン

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ラインの圧力、流量に変動があった時には、圧力計６と流量計７が圧力、流量の変化を検出してノズル調節器１２を経て合流ラインの圧力及びタービンラインの流量を一定に保持するための制御信号をノズル操作器１１に出力する。この場合、圧力と流量の二つの制御要素に対して、まずタービンラインの流量の制御を行い、予め定められた所定値を超えない流量範囲で発電量を最大にするように、タービン流量を所定の最大値に保持すると共に、バイパス用自動調圧弁３の開閉で下流圧を一定に保持する。すなわち、タービンラインの流量が所定値を超えない範囲で該所定値に近づくように可変ノズル１０を開閉制御することによって、前記下流圧を一定に保持させるようにすることが可能であり、しかも、タービン１のオーバーロードを防止することができる。

【００１９】

【発明の効果】本発明は、以上説明したような形態で実施され、以下に記載されるような効果を奏する。

【００２０】本発明のうち請求項１記載の発明は、起動、運転、停止の全ての状況下でタービンの下流圧を一定に保つとともに、運転時において状況に応じた最大の発電量や冷熱量の確保を達成できる。また、所定流量を超えない範囲で運転するためタービンがオーバーロード（過流量）することがなく安定した運転が保証される。

【００２１】また、本発明のうち請求項２記載の発明は、請求項１記載の発明の効果と比較して、運転時におけるより大きなタービンヘッドが得られるため発電量や冷熱量をより大きく取れる効果が奏される。

【図面の簡単な説明】

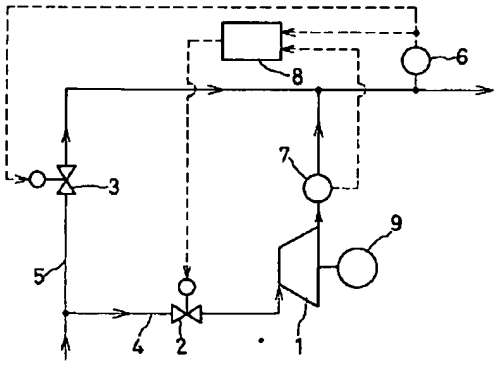
【図１】本発明の一実施例によるガス供給発電プラントの概略系統図である。

【図２】本発明の他実施例によるガス供給発電プラントの概略系統図である。

【符号の説明】

１…膨張タービン、　２…タービン用自動調圧弁、３…バイパス用自動調圧弁、　４…ガス管路、５…バイパス管路、　６…圧力計、７…流量計、　８…圧力流量調節計、９…発電機、　１０…可変ノズル、１１…ノズル操作器、　１２…ノズル調節器、

【図１】



【図２】